

## ON TWO NEW ENTOMOSTRACA FROM CEYLON.

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With two Plates.

A COMPREHENSIVE survey of our knowledge of the freshwater Entomostraca of Ceylon was published in 1898 by Daday, and since then nothing has been added to it so far as I am aware. Combining the species recorded for the first time in his paper with those previously described by Brady (1886) and Poppe and Mrazek (1895), he gives a list containing one Phyllopod, twelve Copepoda, and thirty-six Cladocera. Thanks to the papers of Sars, Stingelin, and Richard, we have a list of Entomostraca from the Indo-Malayan sub-region comprising two Phyllopoda, forty-six Cladocera, and six Copepoda, but practically nothing is known at present with regard to India. We are also far from having a complete knowledge of the Entomostraca of the Ethiopian and Australian regions, so that at present the facts at our disposal are too limited to allow of satisfactory deductions being made with regard to geographical distribution. The difficulty is also much increased by the fact that many genera and some species have a world-wide distribution, and appear to be independent of barriers, which hinder the disposal of other forms. Whether this is due to an extreme adaptability, or indicates a distinction between primitive widely distributed forms and those of more recent origin (Moore, 1903), it is difficult to say. However, so far as the facts go it may be useful to summarize them. Taking the Cladocera as being the most numerous and best known group, we find that of the thirty-six species and varieties recorded from Ceylon thirteen are peculiar to it, so far as is known at present. The following are the numbers of species and varieties common to Ceylon and the various Zoogeographical Regions :—

Palæarctic	..	..	10
Nearctic	..	..	4
Neotropical	..	..	8
Ethiopian	..	..	5
Australian	..	..	10
Indo-Malayan Sub-region	..	..	18

If we exclude those species which are found both in Ceylon and in more than one other region\*—that is, the widely distributed species—the numbers are as follows :—

Palæarctic	..	..	..	1
Neartic	..	..	..	—
Neotropical	..	..	..	—
Ethiopian	..	..	..	—
Australian	..	..	..	—
Indo-Malayan Sub-region	..	..	..	4

The single species found only in the Palæarctic Region and in Ceylon is *Chydorus ovalis*, Kurz. It was recorded by Poppe and Mrazek, but they expressed some doubt as to its identity with the European species. Seeing that the genus *Chydorus* is peculiarly rich in Oriental species, differing but little one from another, this record cannot carry much weight.

From the figures given above it is evident that the Entomostracan fauna of Ceylon contains a large proportion of peculiar forms, and that, of the remainder, those that are limited to a single region are all Indo-Malayan species. There is no doubt therefore that there is a close relationship between the fauna of Ceylon and Indo-Malaya, but it is not safe to speculate on relationships with regions lying further afield.

Through the kindness of Dr. Willey I have recently received specimens of a *Diaptomus* and a *Streptocephalus* collected in Ceylon, and it is further evidence of the richness and peculiarity of the fauna that both species prove to be undescribed. They were collected by Mr. E. E. Green in a muddy stagnant pool on the Cotton Experiment Station at Maha Ilupalama in the North-Central Province of Ceylon when looking for Mosquito larvæ.

The following is a description of these species :—

#### Order : PHYLLOPODA.

##### *Streptocephalus spinifer*, n.sp. (Plate I.)

The body in both sexes is somewhat slender, the head and thorax together a little longer than the abdomen without the caudal rami ; the following are the measurements of three specimens :—

	Female.		Male.	
	I.	II.		
Head and thorax ..	5·25 mm. ..	4·5 mm. ..	5.5 mm.	
Abdomen ..	5·0 mm. ..	3·75 mm. ..	5.0 mm.	
Caudal rami ..	2·0 mm. ..	1·5 mm. ..	2.75 mm.	
Egg sac ..	3·7 mm. ..	2·5 mm. ..	—	
Total length ..	12·25 mm. ..	9·75 mm. ..	13·25 mm.	

\* For the purposes of this comparison I consider Ceylon as a region by itself, distinct from the rest of the Oriental Region.

The head of the male is produced in front, beneath the frontal process, into a distinct, downwardly-curved, spiniform rostrum (fig. 4). The segments of the thorax are simple, as are also those of the abdomen in the female. In the male, on the other hand, each segment, with the exception of the first and the last, bears one or more spines. The second segment bears only a lateral pair, but the next five bear both a pair of long dorsal spines and a lateral spine on each side diminishing in size in the posterior segment. The seventh segment bears a pair of dorsal spines and a pair of very minute lateral spines, and the eighth a single median dorsal spine. The caudal rami in both sexes are long. In the male they are only slightly curved, ciliated at their base, but provided for about the distal two-thirds of their length with strong curved spines on either side (fig. 8). In the female they are more divergent, and fringed with setæ along both edges.

Unlike the majority of the genus *Streptocephalus*, the male has the frontal processes enormously developed. They are fused at their base into a single cylindrical process, but are distinct for the greater part of their length. Distally they divide again into dorsal and ventral branches. The ventral branch is short and simple, but the dorsal branch bears a row of papillæ along its ventral edge. The first pair of antennæ are long, in the male about equalling in length the first joint of the second antennæ, and in the female somewhat exceeding the length of the second pair. The second pair of antennæ in the female are short, narrow, triangular plates fringed with hairs, but without any terminal projection. Those of the male are long chelate appendages. The basal segment is about equal in length to the second segment and bears a long apophysis: the terminal portion is narrow and produced into two long sub-equal processes. Each of these has a small inner lobe at its base of somewhat variable form (fig. 5). The branchial legs are of the usual form (figs. 6 and 7). The basal plate (bract) has its edge serrated. The exopodite is much longer than the endopodite, the distal margin of the latter more or less squarely truncated. The penis of the male (fig. 9) scarcely extends beyond the third abdominal segment, the reversible part not spinous. The egg-sac of the female is narrow, cylindrical, and pointed at the extremity, reaching to the middle of the sixth segment of the abdomen.

Three males and three females of this species were collected by Mr. Green, who describes its appearance in life as follows:—"Prominent black eyes; body pale translucent, yellowish-greenish; a pair of brilliant scarlet cerci at extremity." One or two of the specimens have what appear to be large branching chromatophores

in the posterior part of the abdomen, which perhaps are the seat of the red pigment.

The species is one of peculiar interest in more than one respect. The female is of a perfectly normal type, but the male differs strikingly from any species of *Streptocephalus* hitherto described. In particular it is distinguished by the enormous development of the frontal processes, which about equal the second antennæ in size. In the majority of the species of this genus the frontal processes are reduced and fused into a small plate, sometimes showing traces of its originally paired origin by the presence of a small emargination of the tip; for example, *S. rubricaudatus*, Klunz. and *S. vitreus*, Brauer. In others they are almost entirely suppressed, as in *S. purcelli*, Sars. In only one or two cases are they very conspicuous. These are *S. proboscideus*, Frauenfeld, and *S. neumanni*, Thiele. The frontal processes of the latter are of almost exactly the same type and relative size as those of *S. spinifer*. They differ in that the main fused stem gives off on either side a branch, and is itself produced into a long recurved process. It is, in fact, a trifid frontal process.

The possession by the male of spines on the abdominal segments, which has suggested the name given to the species, is a striking, but not distinctive, feature of it. In *S. neumanni* also the abdomen is armed with spines in the male but not in the female, but in this case they are ventral and unpaired. It appears to be the rule among the Branchipodidæ that such spines, when present, should be possessed by the female and not by the male; for example, *Chirocephalus spinicaudatus*, Simon, and *Chirocephalus carnutanus*, Brauer (see Simon, 1886, p. 400). These two species are exceptions which prove that the spines have no accessory sexual function as one might perhaps otherwise assume.

A point of more morphological importance is the possession of a marked rostrum. Traces of a rostrum are indeed present in more than one species; for example, *Chirocephalus grubei* (Dybowski) and *Branchipus pisciformis* (Schaeffer). In the latter the rostrum is represented by a broad, truncated outgrowth, and I know of no species in which a definite pointed rostrum occurs like that of *Streptocephalus spinifer*.

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Order : COPEPODA.

*Diaptomus Greeni*, n. sp. (Plate II.)

Female; Cephalothorax stout, the greatest breadth falling about the first free segment. The last segment produced on either side into a large wing with two notches (fig. 1). Abdomen consisting of

three segments ; the first, or genital segment, very asymmetrical, produced on the left into a simple finger-like process, and on the right into a wing-shaped process with a distinct notch on its anterior margin (fig. 2). Second segment much shorter than either the first or the third, the line of division between it and the latter very indistinct. Caudal rami half the length of the two last abdominal segments combined, very broad and ciliated internally. First antennæ not reaching beyond the cephalothorax. Fifth pair of feet (fig. 3) with the endopodite one-jointed, about two-thirds the length of the first joint of the exopodite, bearing two short spines at its apex. The spinous prolongation of the second joint of the exopodite is nearly straight, and provided internally with a row of minute denticles ; a long spine springs from near the base of the joint. The terminal joint very small, having the appearance of a bifurcate spine. Genital operculum with the anterior margin slightly sinuate.

Length : 2.0 — 2.3 mm.

Male ; Cephalothorax more slender than that of the female, the last segment not dilated laterally. Abdomen consisting of five segments. The furcal branches somewhat longer than the last segment of the abdomen, narrow, ciliated internally ; the outermost seta of the right branch much thicker than the rest, not ciliated, and with a small tooth on its inner side (fig. 6). The first antennæ do not reach beyond the cephalothorax. The last joint of the prehensile antenna armed with a small claw, as in *D. denticornis*, Wierz. The two preceding joints are simple, without prolongations (fig. 7). The right fifth foot (fig. 8) has the endopodite two-jointed, somewhat longer than the first joint of the exopodite. The first joint of the exopodite is dilated, the last joint long and narrow, with a long terminal claw nearly straight at its base and curved at the end. Near the base of this claw is borne a long spine, bent downwards, and closely pressed to the side of the last joint in such a way as to be scarcely visible when the leg is viewed from in front. This spine, which corresponds to the lateral spine of the ordinary type, is found in this peculiar position in all the specimens, so that the position must be considered normal. In the left fifth foot the endopodite is one-jointed, shorter than the first joint of the exopodite and constricted at the tip. The first joint of the exopodite bears a strong lateral spine and is not distinctly separated from the last joint, which has a folded laminar appearance.

Length : 1.85 — 1.95 mm.

Mr. Green describes the colour : “ Body blue, antennæ and forked hinder part extremely red.”



The species is remarkable for the strongly asymmetrical expansions of the genital segment of the female, and for the modified seta of the right furcal branch and recurved lateral spine of the right fifth foot of the male. These characters, combined with the armature of the prehensile antenna of the male, make *Diaptomus greeni* a remarkably distinct species.

If we compare it with the four species of *Diaptomus* previously recorded from Ceylon, viz., *D. orientalis*, Brady, *D. lumholtzi*, Sars, *D. drieschi*, Poppe & Mrazek, and *D. singalensis*, Daday (Table 1), we find that, though these four species form a fairly homogeneous group themselves, *D. greeni* differs very markedly from all, though approaching nearest to *D. singalensis*. On the other hand, in the possession of a hook on the last joint of the prehensile antenna of the male it agrees with *D. denticornis*, Wierz., *D. alluaudi*, Guerne & Rich., and *D. chevreuxi*, Guerne & Rich., three "Circum Mediterranean" species. Tabulating the most important characters of the four species (Table 2) one finds a considerable further agreement, particularly with regard to the prehensile antenna and the fifth foot of the female. The vestigial condition of the third joint of the exopodite of the latter is common among the North American species of *Diaptomus*, but is otherwise rare. For systematic purposes *D. greeni* may, I think, be classed with the above-named species, and apart from the four remaining Sinhalese species.

TABLE 1.

	<i>D. orientalis</i> .	<i>D. lumholtzi</i> .	<i>D. drieschi</i> .	<i>D. singalensis</i>	<i>D. greeni</i> .
Last segment of the Cephalothorax. $\times$ $\varnothing$	With small wings	With small wings	Scarcely winged	With small wings	With large wings
Genital Segment $\varnothing$	—	—	—	—	With wings
1st Antenna of $\varnothing$ reaches	End of genital segment	End of furca	End of furca	Second abdominal segment	End of Cephalothorax
Last joint of the Prehensile antenna	—	—	—	—	With hook
Last joint but two of ditto	With claw shaped process	With claw shaped process	With a short hook	—	—

	<i>D. orientalis.</i>	<i>D. humholtzi.</i>	<i>D. drieschi.</i>	<i>D. singalensis</i>	<i>D. greeni.</i>
Endopodite of 5th foot of ♀ compared to 1st joint of Exopodite	Same length	Shorter	Shorter	Shorter	Shorter
3rd joint of Exopodite of ditto	Distinct	Absent	Distinct	Distinct	Vestigial
Endopodite of 5th foot of ♂ compared to joint of Exop.	Same length	Longer	Longer	Same length	Longer

TABLE 2.

	<i>D. denticornis.</i>	<i>D. alluaudi.</i>	<i>D. chevreuxi.</i>	<i>D. greeni.</i>
Last segment of the Cephalothorax. ♀	With large wings	With large wings	With large wings	With large wings
Genital segment ♀	Without wings	With ventral spine	With two dorsal elevations, asymmetrical	With wings asymmetrical
1st Antenna of ♀ reaches	Furca	Furca	End of genital segment	End of Cephalothorax
Last joint of the Prehensile antenna	With a hook	With a hook	With a hook	With a hook
Last joint but two of ditto	With a hyaline lamella	Unarmed	Unarmed	Unarmed
Endopodite of 5th foot of ♀ compared to 1st joint of Exopodite ..	Longer	Shorter	Shorter	Shorter
3rd joint of Exopodite of ditto	Reduced	Reduced	Absent	Vestigial
Endopodite of 5th foot of ♂ compared to 1st joint of Exopodite ..	Shorter	Shorter	Shorter	Longer

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## EXPLANATION OF PLATES.

## PLATE I.

*Streptocephalus spinifer*, n. sp.

Fig. 1.—Side view of the female.  $\times 10$ .

Fig. 2.—Side view of the male.  $\times 10$ .

Fig. 3.—Frontal process and rostrum of male from the side.  $\times 37$ .

Fig. 4.—Second Antenna of male.  $\times 37$ .

Fig. 5.—Leg of 9th pair, male, from behind.  $\times 37$ .

Fig. 6.—Leg of 6th pair, female, from in front.  $\times 37$ .

Fig. 7.—Left caudal ramus, male, from above.  $\times 37$ .

Fig. 8.—Penis of male.  $\times 37$



## PLATE II.

*Diaptomus greeni*, n. sp.

- Fig. 1.—Side view of female.  $\times 48$ .  
Fig. 2.—Dorsal view of abdomen, female.  $\times 57$ .  
Fig. 3.—Fifth pair of legs, male.  $\times 100$ .  
Fig. 4.—Genital operculum, female.  $\times 150$ .  
Fig. 5.—Dorsal view of male.  $\times 47\cdot5$ .  
Fig. 6.—Furca of male, ventral view.  $\times 100$ .  
Fig. 7.—Part of prehensile antenna of male.  $\times 105$ .  
Fig. 8.—Fifth pair of legs.  $\times 100$ .  
Fig. 8a—Endopodite of right foot enlarged.  
Fig. 9.—Fifth foot of male ; end of last joint of exopodite to show recurved lateral spine.